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INFORMATION TECHNOLOGY  
A DIFFERENCE IN SCOPE OR KIND?

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## INFORMATION TECHNOLOGY A DIFFERENCE IN SCOPE OR KIND?

*Before the Wright Brothers, air, while it obviously existed, was not a realm suitable for practical, widespread military operations. Similarly, information existed before the Information Age. But the Information Age changed the information realm's characteristics so that widespread military operations within it became practical.*

### CORNERSTONES OF INFORMATION WARFARE United States Air Force

I started this paper as an investigation of Real Time Information to the Cockpit (RTIC) which involves providing information from one sensor to one shooter. However, I quickly found myself drawn into an investigation of something much larger and I believe, much more fundamental. Are we at the verge of a "revolution" in warfare? This paper proposes that we in the military have yet to answer the fundamental questions surrounding information technology's impact on operations, organization, or doctrine. In typical fashion we have attacked the hardware problems and left the tougher issues of doctrine and implementation until later. Well, "later" has arrived and the quicker we come to grips with these most fundamental issues the better -- for both our military and our nation.

As I mentioned earlier, I started this paper because about four years ago I was involved with the early development of RTIC and found its potential fascinating. However, even then I could see that no one was working the corresponding issue of how to implement this technology in an operational setting with multiple sensors and multiple shooters. In other words, we had proven the technology in a controlled environment but hadn't explored it outside the laboratory where "fog and friction" were sure to take their toll. Who would "make the cut" on distributing the information and how could we avoid "information overload?"

Indeed, my research readings took me down a most fundamental path. I found myself beginning to connect the issues of technology with operations, organization, and finally doctrine. Therefore, I will begin with RTIC but expand my discussion to include operational, organizational, and doctrinal issues. What type of organizational structure do we need in order to take advantage of information technology? What doctrinal modifications are needed to accommodate an information intensive future? Does information technology blur our traditional concepts of strategic, operational, and tactical warfare? The length of this paper will not permit me to offer a detailed analysis of each subject, but if I simply generate some “food for thought” then I’ve been successful.

However, before I begin let me explain what this paper is not. This paper is not a discussion of “cyberwar.” This isn’t to say that this dimension of information warfare isn’t worthy of discussion or exploration, but simply that it isn’t the focus of this paper. Computer-on-computer warfare is a fact and will no doubt continue to find its way into the military’s “operational” lexicon. However, because of this paper’s limited length, any inference to this type of “warfare” will have to be in passing only. This paper will center instead on those information technologies that include real-time and near real-time capabilities in an ever expanding “battlespace.” We must come to grips with the fundamental question of whether these technologies offer us a revolutionary capability or simply new tools to solve old problems. Do today’s information technologies really represent a difference in kind or just a difference in scope? To quote from a RAND study by John Arquilla and David Ronfeldt, Information warfare “is not merely a new set of operational techniques. It is emerging as a new mode of warfare that will call for new

approaches to plans and strategies, and new forms of doctrine and organization” (Arquilla,

20) Let’s see if we agree

## RTIC ON A GRAND SCALE THE NEED FOR AN EFFECTIVE DECISION ARCHITECTURE

*Information technology advances will make dramatic changes in how this nation fights wars in the future. They will allow a commander's vision and view of the battlespace to be shared at the lowest level. Because of this, every practitioner of the profession of arms has a responsibility to understand the impact of information warfare on their service. From our unique perspectives as soldier, sailor, marine, and airman, we can then forge a common understanding of how to use information warfare to enhance joint warfighting capabilities.*

Ronald R. Fogleman  
General, USAF  
Chief of Staff

Shiela E. Widnall  
Secretary of the Air Force

In the end, warfighting comes down to decisionmaking. Whoever can make the “best” decisions in the quickest possible time will prevail. In the tactical sense, this might be the first warfighter (fighter pilot, tanker, sailor, or soldier) to acquire his adversary, determine his intent, and fire his weapons. This concept can also be applied at the operational and strategic levels of war where those in critical leadership positions are trying to preempt the decisionmaking of their counterparts. Therefore, in the aggregate whomever can accomplish this task with the greatest success will gain victory (Czerwinski, 13). We call this cycle of Observing, Orienting, Deciding, and Acting, the OODA loop or decision cycle (Figure 1).

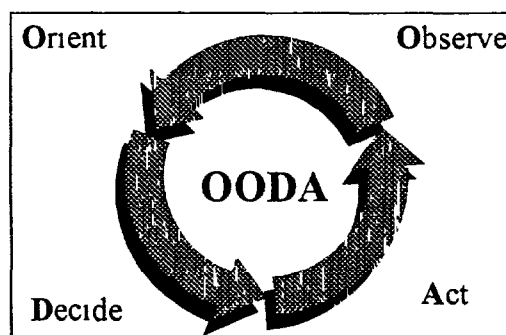


Figure 1

In order to succeed you must get inside your adversary's decision cycle to continually anticipate and preempt his actions before he can do the same to you. Real Time Information to the Cockpit (RTIC) is intended to do just that. It represents one of the latest uses of information technology to provide a decisionmaking advantage. In this case, it is a very specific capability of transferring information (be it airborne or spaceborne) directly to an aircraft in real-time (Figure 2). In other words, as the information is collected it is transmitted immediately to the aircraft and thereby, giving a significant information (decisionmaking) advantage to the warfighter in the aircraft.

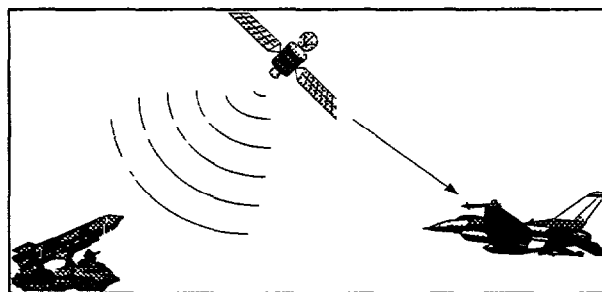


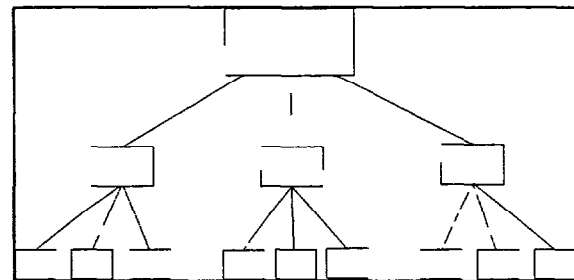
Figure 2

To date, we have focused our attention on the challenge of hardware. How to collect data, electronically transfer it, and then effectively display it. However, most of these formidable problems have now been solved and what remains is the problem of taking them from the "lab" into a working environment -- the only place that matters. Unfortunately, this is where our efforts have traditionally fallen short. One only needs to remember our early and ineffective methods of adapting the tank and aircraft to U S warfighting doctrine. Perhaps we fail because once the hardware problems are solved the issues becomes less scientific and more theoretical, political, and emotional. For now we can talk about *information* flow but ultimately we will have to address the tough issues of command and asset ownership.

We need to create an effective decision architecture that accommodates our technology boom without overloading the warfighter with information that is irrelevant to

his situation We need to devise an organizational structure that will permit timely decisions to be made at the optimum decisionmaking level There are a number of issues surrounding the effective incorporation and employment of information technologies The first issue is the concept of hierarchy and its relationship to time and the second issue is related to survivability

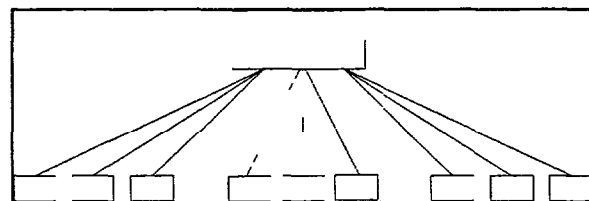
The military is a very hierarchical organization (Figure 3) Such a hierarchical tradition is born from the necessity to maintain order in the midst of chaos Historically, it was this type of organization



**Figure 3**

that provided the military the ability to maintain control and disseminate information across a chaotic battlefield The hierarchical structure provided an effective means of disseminating information for those who only had limited means (messengers, short range radios, etc) However, given today's

world of nearly unlimited connectivity a flatter, more centralized structure



**Figure 4**

becomes optimum From the standpoint of reducing decision time, the flatter the

organization the better (Figure 4) Humans now represent the longest delay in any modern decision architecture (Marines, 94) The more human interaction that can be reduced between the decisionmaker and his implementers (warfighters), the smaller the decision cycle becomes However, from the military standpoint there are two tremendous

drawbacks to such an organizational structure. The first is survivability and the second is micromanagement.

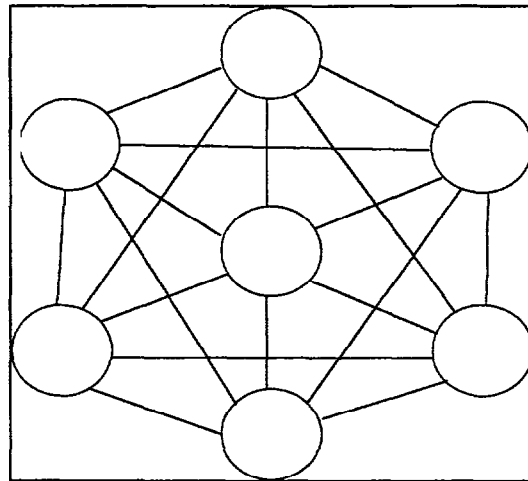
Within the military context, we must deal with a dynamic environment where the adversary is aggressively and quite predictably trying to sever our information lines. He tries to introduce confusion by separating the Commander from his forces. If your adversary is able to discern such a centralized information structure, it will undoubtedly become the focus of his attack and whatever success he has in isolating the leadership will have a devastating effect on operations.

The second concern that the military (and any other organization for that matter) has in flattening its organization is that such a structure invites superiors to micromanage. Top level leadership, be it Generals or CEO's, will barely be able to restrain themselves from "meddling" or micromanaging in the affairs of subordinates. The siren song of *real time* information will tempt them to run even the most mundane of operations. However, there are two very real drawbacks to this approach. The first has to do with the need to retain an autonomous capability for wartime and the second is the dilatory effect micromanagement has on motivation and initiative.

Although our *real time* capabilities have remarkably increased, they are still not -- *real time*. One must be able to consider the information instantly and in the context of the moment. As stated before, what if the link is broken? Subordinate commanders must have the ability and *inclination* to act autonomously. The best method to ensure that they develop this skill is to make it the default mode. Finally, until robots fill our ranks those who are asked to go in harm's way will want to have some level of control over their environment. The morale and initiative that springs from this type of control is palpable.



Therefore, the best method proposed for dealing with the failings of a strictly hierarchical approach in the information age is a networked approach (Figure 5) The Air Force calls it Distributed Battle Management or DBM (Lewis,iii) It is an approach that is thought to provide the best compromise for dealing with uncertainty and time (Marines, 125) In this method the leader is still able to exercise control but in a less direct and therefore, restrictive way The leader is



**Figure 5**

called upon to provide his image or vision (Kahan,9 Marine Corps, 88) The analogy today would be the commander's intent With this shared image, the individual cells are free to operate at their optimum level of speed and still able to share broader range views of the operation A networked approach would also favorably address the issues of survivability and micromanagement Although some time might be lost from a purely flat hierarchical approach, it would be minimal since all cells would be interconnected and communicate simultaneously This isn't to say that such a concept is without challenges Because of simultaneity, there would be a very real need to manage the immense flow of data Cells would be pulling data from sensors and the net while simultaneously pushing data to the net as well Several methods of managing this overwhelming flow of data have been proposed, among them hardware solutions, software solutions, and organizational solutions This of course cuts to the thrust of this paper, that we haven't yet properly

explored a means of “operationalizing” the potential offered by real-time information technology

Hardware considerations include limiting the type of equipment and providing direct connectivity. However, software solutions show the most promise. These might include programmable “filters” and improved data processing that apply commander driven algorithms thereby giving him just the information he requests (Marshall, 93). Ultimately, however the organization scheme adopted will determine the final solution. Therefore, this is where we need to focus our attention -- at the organization and its underlying traditions and doctrine.

The military needs to come to grips with the new information technologies, determine their potential to alter our traditional concepts of warfare, and then get on with the business of adopting it in its most effective form. One of the most fundamental questions is whether the information age has delivered us into a new era of warfare or has simply provided new tools to accomplish old tasks?

#### INFORMATION TECHNOLOGY EVOLUTION OR REVOLUTION?

*“From Plato to NATO, the history of command in war consists essentially of an endless quest for certainty.”*

*Van Creveld*

Information, communications, and control are enduring concerns of warfighters, there is much historical evidence, tactical and strategic, that attempting to pierce the “fog of war” and envelop one’s foe in it has played a continuing role (Arquilla, 9). Several examples from history serve to illustrate

Carthaginian forces under the command of Hannibal routinely stationed observers with mirrors on hilltops, keeping their leader apprised of Roman movements while the latter remained ignorant of his. In the most dramatic example of the use of superior information, Hannibal's relatively small forces were able to rise literally from the "fog of war" at Lake Trasimene to destroy a Roman army more than twice its size (Arquilla, 9)

The Mongols were also expert practitioners of information dominance. Scouts and messengers always took along three or four extra horses, tethered, so that they could switch to fresh mounts. This gave the horsemen, in relative terms, something approximating an ability to provide "near real-time" intelligence, almost as from a satellite, on the enemy's order of battle and intentions. In terms of organization, the Mongols employed decentralized command in the field, unlike their foes who were generally required to wait for orders from their capitals. By developing an effective, near real-time communication system to keep their leadership apprised at all times the Mongols combined decentralization with topsight (Arquilla, 12)

The relative importance of information and control took a jump with the advent of mechanized warfare. One of the enduring lessons of blitzkrieg warfare was the value of disrupting the enemy's command and control, to get inside his decision cycle and stay there. However, one of the often overlooked factors that significantly contributed to blitzkrieg effectiveness was the fact that radios were used in individual German tanks. A particularly noteworthy example of a new information technology being effectively incorporated with visionary doctrine -- something this paper proselytizes

With all of these developments in "technology" the size of the battlefield increased while the time it took to pass information decreased. Today, as we combine our

ability to strike at ever increasing ranges with increased accuracy and lethality, does information technology offer us the tool to revolutionize warfare as we currently think of it? Some thoughts to consider

First of all, consider the link with the past. We have always had information flow on the battlefield and those who were most successful in command and control were most often victorious. However, our ability to see has normally exceeded our ability to influence or destroy. I would argue that today the ability to see has taken a quantum leap forward at the same time our ability to strike deep has become a reality. All we need is the communication and decision architecture to make it devastatingly effective. This, I think, would create not just a change in scope but a change in kind as well. I say this because as the "battlespace" has expanded, the ability to simultaneously affect the strategic, operational, and tactical levels of war has become a reality. Air Force directives already speak of the Joint Force Air Component

Commander (JFACC) being able to monitor and affect all three levels of war -- simultaneously (Lewis, 6). This creates a fundamental shift in our traditional ways of prosecuting war (Figure 6). This is not to

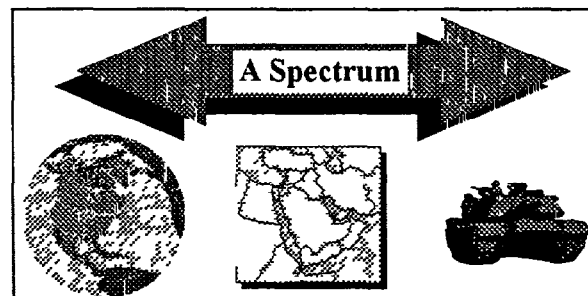


Figure 6

say that the three terms become anachronistic but that they begin to blur together and their relative weights also begin to shift (MacGregor, 33). Consider Desert Storm as an example. The effect of our early strategic victory by air did not obviate our need for a ground operation, yet many would argue that it did predetermine its outcome. In that war we combined information dominance with the newfound lethality of precision deep strike

weapons to create an overwhelming asymmetry in capability. As we improve our ability to communicate the battlespace picture in near real-time will information technology begin to lessen the significance of individual tactical and operational engagements? I believe individual engagements will continue to ultimately determine success or failure in war. However, information technology can not only contribute to the success or failure of individual engagements but can “see” their strategic significance. *This* represents a fundamental change.

So we come to a point of departure. If one recognizes the revolutionary trend now offered by information technology, when do we make our break with the past? I would argue that because of the nature of information technology and its exponential rate of growth, the sooner we make the break the better. Remember the OODA loop. The quicker we make the leap and embrace real-time technologies the quicker we can take steps that guarantee our decision cycle dominance. This would involve significant modifications to vision statements and perhaps more importantly, budget commitments. Ultimately, if we believe that this is where the future is headed, and I do, then we must give these technologies budget priority. If budgets are indeed headed downward, what better way to leverage limited funds? The first step is to develop a vision of the future, organizationally and doctrinally, that will focus our hardware efforts.

## CONCLUDING THOUGHTS

*Reams have been written about the impact of this technical revolution on the conduct of war, particularly since Desert Storm. However, most of the literature focuses primarily on technical developments, not on how these developments impact doctrine.*

CORNERSTONES OF INFORMATION WARFARE  
United States Air Force

I have seen the future and it is here RTIC gave me a keen insight into the future that was both exhilarating and at the same time -- despairing Exhilarating because I saw a technology advance that gave the U S unparalleled decisionmaking advantages However, I despaired because I didn't then, nor have I yet, seen any serious steps taken towards giving this capability a warfighting edge We need an effective decision architecture and doctrine to give this technology warfighting relevance

We find ourselves at the same type of crossroads with real-time technologies that we found ourselves in with the tank and airplane All we saw in the tank was the limited ability to defeat a machine gun Many thought it was little more than a threat to the horse cavalry and insisted that it only support infantry It wasn't until some foreign visionaries came along that the U S finally awoke Likewise with the advent of the aircraft The U S military establishment fought hard and long to keep it from threatening our "established ways" Again, we in the U S military had to have foreign officers find an effective military use for a scientific discovery that U S know-how had dropped in our lap Today's information technologies are *our* tank and airplane

Clearly, information technologies represent a change in "sea state" Organizationally, the networked approach shows the most promise but what I really am arguing for is aggressive research and testing to *ensure* it is the best approach To quote David Alberts from The Future of Command and Control with DBK "These technologies offer opportunities that cannot be realized using the existing organizational approaches" (Alberts, 87) Does information warfare represent a fundamental change in warfare? Yes *and* no

It takes the old concepts of battlefield information and elevates them to unprecedented levels In ancient times the warrior knew only what he could see and only kill what he could touch With the advent of intervening technologies such as the airplane and gun that battlespace expanded tremendously However, what we are witnessing now

is a quantum leap in *both* the ability to see and destroy – in *real-time*. Therein lies a fundamental change presented by information technologies. A second change has to do with the issue of command and who “owns” the battlefield. If we adapt the concept of a “networked” battlefield, doesn’t that require a fundamental shift in our concept of command? Who is responsible if *all* are responsible? Who *owns* the assets being instantly diverted across the battlefield? A “Commander’s” battlespace (the area he can directly influence) is now almost unlimited and can be interpreted without delay. The fundamental concepts of strategic, operational, and tactical operations also begin to blur as his ability to influence all portions of the battlespace, simultaneously, becomes a reality.

However, one factor that makes this technology no different than those of the past is that for each technology discovered, one’s adversary quickly adapts measures to counter it. I don’t doubt that this will happen again but I don’t want to be the one with an early disadvantage. Again, given the nature of information technology and the asymmetry it offers, if we don’t get this right the first time, there may not be a *second* time.

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